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# Apexification in non-vital teeth with incomplete root formation associating calcium hydroxide and mineral trioxide aggregate: a case report

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## ABSTRACT

**Introduction:** Immature teeth with pulp necrosis constitute a challenge to endodontic therapy. Our objective was to describe the management of a tooth case of with incomplete rizogenesis and pulp necrosis. **Methods:** Patient, male, 13-years-old, with a history of dental trauma in the maxillary central incisors. After confirmation of pulp necrosis, the teeth were submitted to calcium hydroxide intracanal and, posteriorly, apicification with MTA and obturation with gutta-percha. **Results:** After 20-month follow-up, suppression of the pain

symptomatology, absence of periodontal impairment and reduction of the periapical lesion were observed. At 60 months, periodontal health maintenance and complete healing of the periapical lesion were confirmed. **Conclusion:** Association of intracanal calcium hydroxide with MTA in apicification procedure is a viable alternative to the endodontic treatment of non-vital teeth with incomplete rizogenesis.

**Keywords:** Dental Implantation. Endosseous. Endodontic. Root Canal Obturation. Root Canal Therapy. Root Canal Filling Materials.

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## Introduction

Dental traumatism commonly affects young patients with immature teeth.<sup>1</sup> These teeth, with incomplete incomplete root formation, whenever associated with dental pulp necrosis may presents a challenge to endodontic therapy.<sup>2,3</sup> With the interruption of dentin formation, the canal takes on thin and fragile dentin walls and foraminal divergence associated with periapical radiolucent image and open apex.<sup>2,4</sup>

In these cases it is imperative to create an artificial apical barrier or to promote the induction of apical foramen closure through the formation of a mineralized tissue, a process denominated apicification.<sup>5-7</sup>

Apicification is the apical closure procedure that can be performed by the induction of mineralized barrier formation with calcium hydroxide<sup>6,7</sup> or by the creation of an artificial barrier with aggregate mineral trioxide (MTA).<sup>8,9</sup> Calcium hydroxide, with various vehicles, has traditionally been used.<sup>6,7</sup> Due to the root development stage, the complete formation of the apical barrier can be delayed and several sessions are required to exchange the material inside the canal. Treatments with a duration of 6 to 24 months are described.<sup>8,7</sup> After formation of the calcified apical barrier the root canal is obturated using conventional techniques.<sup>8,7</sup>

Nowadays, MTA offers a promising alternative in apicifications, presents biocompatibility and does not promote significant tissue inflammation.<sup>10</sup> Additionally, this material has good sealing ability and allows the repair process in several situations, inducing the deposition of dentinal, cementary and/or bone tissue.<sup>11-13</sup> In addition, the treatment time is reduced and can be performed in unique session.<sup>2</sup> However, further conclusive clinical studies on the use of MTA as an apical barrier in the apicification procedures are required.<sup>2</sup>

Therefore, the objective of this study was to describe a case of apicification by the use of MTA in two upper central incisors of the same patient, with a history of dental trauma, pulp necrosis and open apex, as well as 60 months follow up.

## Case Report

A 13-year-old male patient attended the Dental Clinic of the Brazilian Dental Association, Montes Claros Regional, MG, Brazil, for treatment of the right maxillary central incisor, whose crown was color altered.

During the anamnesis, the patient reported having suffered trauma for approximately 5 years and, due to the absence of pain, did not seek care. At the clinical examination, a fistula was observed in the periapical region of the right maxillary central incisor. The initial radiographic examination (Fig 1A) revealed the presence of periapical lesion in the upper central incisors, which also demonstrated incomplete root formation. The teeth responded negatively to the cold thermal test (Endo-Ice, The Hygenic Corp., Akron, OH, USA), suggesting a diagnosis of pulp necrosis. In view of these findings, the need for a prioritization procedure prior to endodontic treatment was explained to the patient's parents, who signed a free informed consent form and consent for documentation and future publication of the case.

In the same session, anesthesia was performed by the infiltrative technique with lidocaine 2% with epinephrine 1: 200,000 (Alphacaine, DFL, Rio de Janeiro, RJ, Brazil) followed by absolute isolation and access to root canals. The pulp chambers were copiously irrigated with 1.5% NaOCl and the channel was run with 3a series K-type files (Dentsply, Maillefer, Ballaigues, Switzerland). The working length was determined radiographically (Fig 1B). The K type 3a series files were worked with smooth brush strokes against the walls of the channels, concomitantly with the irrigation and aspiration of the same. Subsequently, the channel was paper cone dried and filled with Calen<sup>®</sup> calcium hydroxide based dressing with PMCC (SS White, São Paulo, Brazil), and provisional sealing with Coltosol (Vigodent, Rio de Janeiro, Brazil).

After one month, it was decided to perform the procedure of apicification with MTA to seal the apical region and allow root canal filling. The calcium hydroxide dressing was removed with irrigation and the channel was dried with paper cone 80. The MTA (Angelus, Londrina, PR, Brazil) was handled according to the manufacturer's recommendations, taken to the root canal in small portions with aid of an MTA port, and condensed with manual capacitors (Odous de Deus, Belo Horizonte, MG, Brazil) of white MTA until obtaining a 5mm apical plug (Fig 1C). Finally, new sealing with Coltosol was performed.

The patient returned in 30 days and, after the absolute isolation and removal of the provisional sealing, the tooth was obturated by the rolled cone tech-

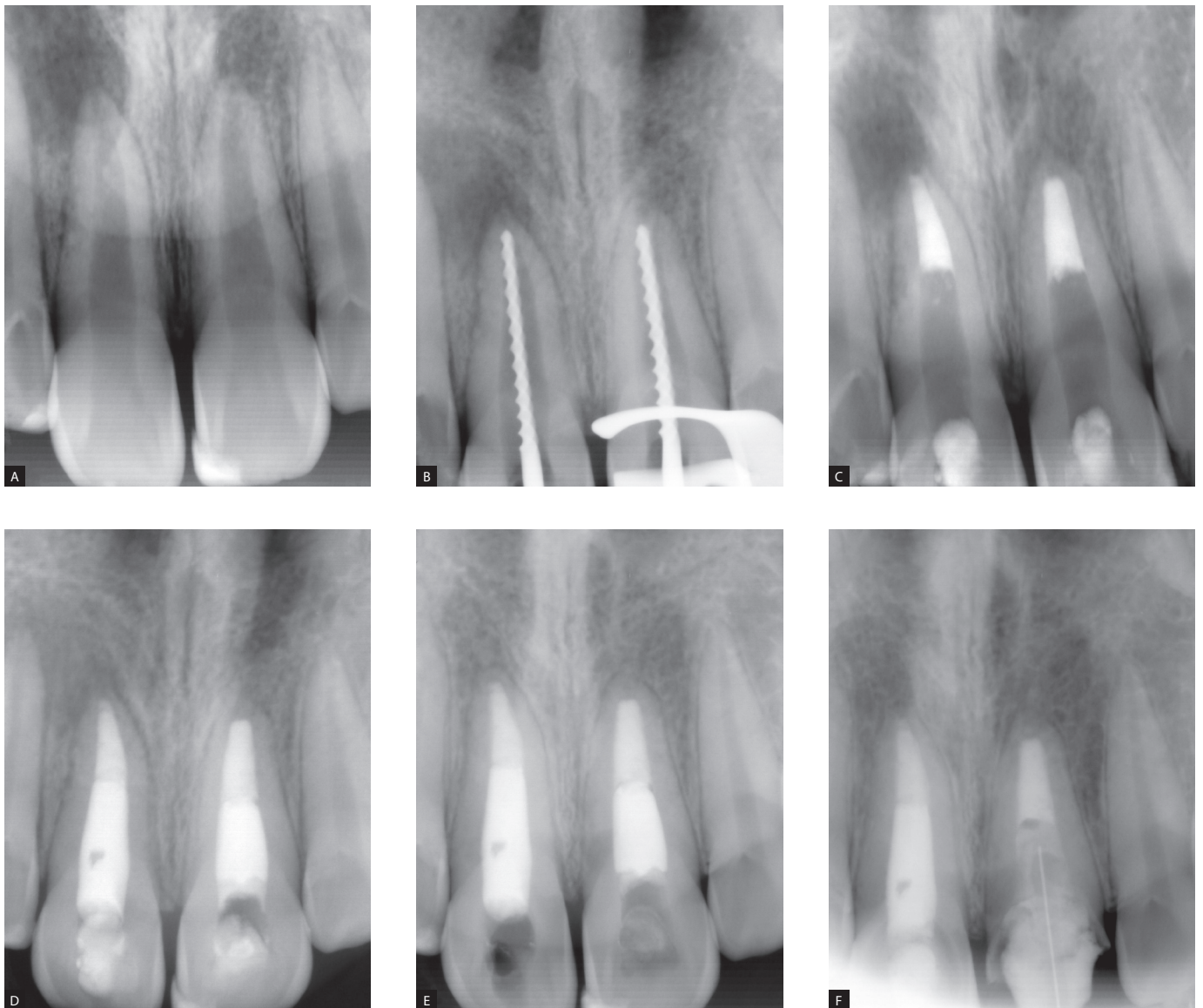
nique, considering the amplitude of the root canal. After the obturation, a new radiographic outlet was performed for final confirmation of the obturation (Fig 1D).

At 6 months, the patient returned to the clinic for control and evaluation. At the clinical examination, the integrity of the periodontal tissues and absence of fistula and painful symptomatology were evidenced. Radiographic examination revealed reduction of the periapical lesion (Fig 1E). In a 60-month follow-up, it was possible to clinically observe periapical health maintenance and complete healing of the periapical lesion (Fig 1F).

## Discussion

One of the main causes of pulp necrosis in immature teeth is dental trauma.<sup>1,7,14</sup> In the present case, a young adolescent who, having traumatized the permanent incisors, later sought the dental service, which frequently occurs in similar cases.<sup>1,4,7,14</sup>

Non-vital teeth with incomplete rizogenesis should be submitted to a prioritization procedure prior to complete and adequate obturation of the root canals. Traditionally, such a procedure is performed with intracanal calcium hydroxide, for its antimicrobial properties and biocompatibility.<sup>2,6,8,9</sup> However, this procedure requires several treatment sessions, due to



**Figure 1.** A) Initial periapical radiograph of the maxillary central incisors. B) Odontometry. C) MTA apical plug. D) Final radiography after obturation. E) Final radiography after obturation. F) Follow-up at 60 months.

the need for several changes of the medication until the formation of mineralized tissue at the root apex, which may hinder the cooperation and adherence of the patient to the treatment, as well as increase the risk of dental fracture.<sup>9,10</sup> However, in this case report, intracanal calcium hydroxide was used in view of this properties.

Currently, the MTA has been indicated as an alternative to the apicification procedure, since it creates an artificial apical barrier, allowing adequate filling of the teeth in question.<sup>2,15,16</sup> Among the advantages of the MTA on calcium hydroxide are the reduction of the treatment time and consequent reduction in the number of visits to the specialist, a fact that guarantees greater patient attendance to the treatment.<sup>10,17</sup> In addition, calcium hydroxide may increase the risk of fracture of the dental element due to the need for successive changes in intracanal medication as well as susceptibility to reinfection since the tooth is filled by temporary sealing during treatment.<sup>9,10</sup> In this case, it was decided to combine both techniques, taking advantage of the potential disinfectant of calcium hydroxide as intracanal medication and the agility of the treatment with MTA.

As for the thickness of the MTA barrier, we chose the thickness of 5mm. In a previous study, it was verified that an apical barrier of 5 mm of MTA provided no infiltration in 100% of the samples.<sup>18</sup> In a similar study, Adel et al. (2012)<sup>19</sup> demonstrated that 5mm apical barriers had a lower infiltration index compared to 3mm. In addition, another study using the microhardness test revealed that the 5 mm barrier was significantly harder than the 2 mm barrier, regardless of the type of MTA or technique used.<sup>20</sup>

A high success rate has been revealed by the use of the MTA.<sup>5,9,15,16,21,22</sup> In a prospective case-series study<sup>13</sup> evaluated the outcome of appendicitis on open-apical teeth using MTA in 50 patients. The eval-

uation was performed at 6 months, 12 months and annually in the following years, using the radiographic parameters: periapical index (PAI) and diameter of the apical lesion. Success was achieved in 81% of cases, which proves the predictability of the use of this material in apicificação, demonstrating that this is a viable alternative to the use of calcium hydroxide.

In a systematic review<sup>2</sup> was observed that MTA is appropriate for clinical endodontic management in the apicification process, when there is apical resorption or excessive mechanical amplification of the apical region. This material promotes the biological repair and regeneration of the periodontal ligament and has good sealing ability. Nevertheless, more conclusive clinical studies are needed on the use of MTA as an apical barrier in the inoculation procedures.

In addition, it is essential a long time of follow-up of these cases to verify the regression of the lesions and maintenance of the periapical health.<sup>14,23</sup> Since several factors are associated with root apex closure, such as proper cleaning of the root canal, reduction of the number of microorganisms, type of material and residence time inside the canal, as well as the patient's own biological response.<sup>23</sup> In the case presented, a follow-up of 5 years, as in other clinical cases,<sup>14</sup> was sufficient to demonstrate the success of the treatment instituted.

## Conclusion

The apicification procedure combining intracanal calcium hydroxide with MTA is a viable alternative to the endodontic treatment of non-vital teeth with incomplete rizogenesis, since it reduces the time of treatment and is easy to apply, adding the properties of both materials. In a follow-up of 60 months using this association, this case report showed total healing of the periapical lesion, as well as remission of the symptomatology, accusing treatment success.